Claims

What is claimed is:

1. A device to provide the controlled release of a biologically-active agent to a body, comprising:

an implantable catheter to be implanted within the body, the implantable catheter having a port to release the biologically-active agent to the body; and

a pair of electrically conductive members each located in proximity to the port, whereby the release of the biologically-active agent to the body is controlled through the generation of a voltage potential difference between the conductive members.

2. The device of Claim 1, and further including a control circuit coupled to the implantable catheter to selectably generate the voltage potential difference between the conductive members.

3. The device of Claim 2, wherein the port includes a cap member formed of conductive material, wherein a first one of the conductive members is electrically coupled to the cap member, a second one of the conductive members is adjacent to the cap member, and whereby the cap member may be dissolved when exposed to a conductive solution and the voltage potential between the conductive members is generated.

4. The device of Claim 2, and further including an expandable member adjacent to the port and in contact with a cross-linked polymer gel, and wherein the first and second conductive members are positioned to generate an electrical field across the cross-linked polymer gel upon the generation of the voltage potential difference, whereby the cross-linked polymer gel expands to exert force on the expandable member to control the release of the biologically-active agent to the body.

5. The device of Claim 4, wherein the expandable member is a disk member containing the cross-linked polymer gel, the disk member having an opening adapted to close upon

expansion of the cross-linked polymer gel to prevent the biologically-active agent from exiting the port.

6. The device of Claim 4, wherein the port is in proximity to a reservoir containing the cross-linked polymer gel, the dimensions of the reservoir being defined on at least one side by a slidable member which slides upon expansion of the cross-linked polymer gel to cause the biologically-active agent to exit the port.

7. The device of Claim 4, wherein the port is in proximity to a reservoir containing the cross-linked polymer gel, the dimensions of the reservoir being defined on at least one side by a collapsible member that collapses against the port upon expansion of the cross-linked polymer gel to prevent the biologically-active agent from exiting the port.

8. The device of Claim 2, and further including a reservoir to store the biologically-active agent that is located in proximity to the port.

9. The device of Claim 2, and further including a storage reservoir that is remotely located from the port to store the biologically-active agent, and wherein the catheter includes a lumen that is in fluid communication with the port and with the storage reservoir to deliver the biologically-active agent to the port.

10. The device of Claim 9, and further including an infusion pump coupled to the storage reservoir to pump the biologically-active agent to the port.

11. The device of Claim 8, wherein the storage reservoir is re-fillable.

12. The device of Claim 2, and further including at least one additional port to release the biologically-active agent to the body, each of the at least one additional ports being associated with a pair of electrically-conductive members to control the release of the biologically-active

agent to the body through the generation of a voltage potential difference between the conductive members.

13. The device of Claim 12, and further including a second control circuit carried on the body of the catheter and being coupled to each of the pairs of the electrically-conductive members to selectably drive the voltage potential difference to one or more of the pairs of the electrically-conductive members.

14. The device of Claim 12, wherein the ports comprise a binary array of ports.

15. The device of Claim 2, and further including at least one electrode carried by the catheter to provide electrical stimulation to the body.

16. The device of Claim 15, wherein the control circuit includes processing means for coordinating the delivery of the biologically-active agent with the electrical stimulation.

17. The device of Claim 16, wherein the electrode is adapted to provide cardioversion/defibrillation stimulation, and wherein the processing means controls the delivery of the biologically-active agent prior to delivery of the cardioversion/defibrillation stimulation to reduce patient discomfort associated with the cardioversion/defibrillation stimulation.

18. The device of Claim 2, and further including at least one biological sensor carried by the catheter to provide a signal indicative of a physiological condition.

19. The device of Claim 18, wherein the control circuit includes processing means to control the delivery of the biologically-active agent in response to the signal indicative of the physiological condition.

20. A method for delivering a biologically-active agent to a body, comprising the methods of:

a.) positioning a drug delivery catheter at a predetermined location within the body, the drug delivery catheter having at least one port and first and second conductors located in proximity to the port; and

b.) generating a voltage potential difference between the pair of conductors to control the release of the biologically-active agent to the body via the port.

21. The method of Claim 20, wherein the at least one port includes an electrically-conductive cap member, and wherein method b.) includes the method of dissolving the cap member by electrically coupling the first conductor to the cap member and causing a current to flow from the first conductor to the second conductor through fluids in the body.

22. The device of Claim 20, wherein the port is in proximity to a quantity of cross-linked polymer gel, and wherein method b.) includes the method of generating an electrical field across the cross-linked polymer gel to cause the cross-linked polymer gel to expand and thereby exert a force that controls the release of the biologically-active agent to the body.

23. The method of Claim 22, wherein the catheter includes a slidable member having a first surface in contact with the quantity of cross-lined polymer gel and having a second surface in contact with the biologically-active agent, and wherein method b.) includes the method of causing the cross-linked polymer gel to expand and exert force against the slidable member so that the slidable member forces a predetermined portion of the biologically-active agent from the port.

24. The device of Claim 22, wherein the catheter includes an expandable member in contact with the cross-linked polymer gel, and wherein method b.) includes the method of causing the cross-linked polymer gel to expand and exert a force against the expandable member so that the expandable member blocks the port to prevent delivery of the biologically-active agent.

25. The device of Claim 20, wherein the catheter includes a reservoir in proximity to the port to store the biologically-active agent, and wherein method b.) includes the method of releasing the biologically-active agent from the reservoir to the body via the port.

26. The device of Claim 20, wherein the catheter includes a storage reservoir that is remotely located from the port to store the biologically-active agent and a lumen in fluid communication with the port and with the storage reservoir, and wherein method b.) includes the method of delivering the biologically-active agent from the storage reservoir to the port via the lumen.

27. The device of Claim 26, wherein the catheter includes an infusion pump, and method b.) includes the method of pumping the biologically-active agent from the storage reservoir to the port via the lumen.

28. The method of Claim 26, and further including the method of refilling the storage reservoir with the biologically-active agent.

29. The method of Claim 20, wherein the catheter includes at least one additional port to release the biologically-active agent to the body, and further including the method of selecting one or more of the ports from which the biologically-active agent will be delivered.

30. The method of Claim 20, wherein the catheter includes at least one electrode to provide electrical stimulation to the body, and further including the method of coordinating the delivery of the biologically-active agent with the delivery of the electrical stimulation.

31. The method of Claim 19, wherein the catheter includes at least one biological sensor to provide one or more biological signals, and further including the method of delivering the biologically-active agent in response to the one or more biological signals.